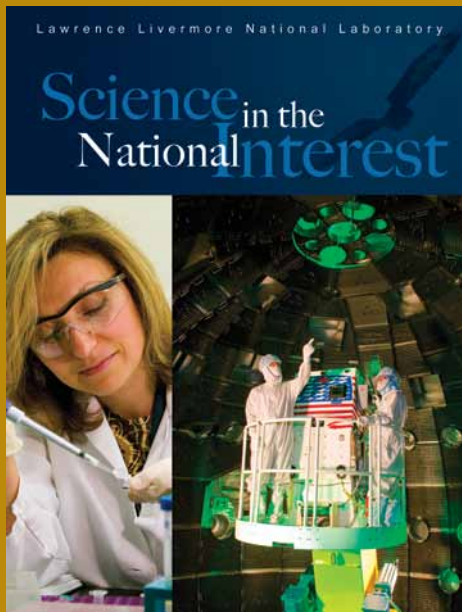


Lawrence Livermore National Laboratory

Science in the National Interest



About the Cover



Two major research thrusts at the Laboratory are the development of countermeasures for biological weapons (left) and completion of the world's most powerful laser, the National Ignition Facility, to study high-energy-density physics and fusion energy (right).



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A Message from Director George H. Miller



The Laboratory is preeminent in its ability to harness the power of science and technology to solve critical national security challenges.

Since its inception, Lawrence Livermore National Laboratory (LLNL) has embraced its role as a “new ideas” laboratory, focusing on novel concepts and innovative approaches to national security science and engineering and tackling problems that others regard as too hard. This approach is more important now than ever before, as dangers from nuclear proliferation and terrorism to energy shortages and climate change threaten both national security and global stability.

A tradition of innovation, excellence, and team science dates to the Laboratory’s early years and its breakthrough successes in the development of compact thermonuclear weapons that form the basis of the nation’s nuclear deterrent. This tradition continues today with stunning accomplishments in predictive science using supercomputer simulations, the design and construction of the world’s largest laser for fusion experiments, and the invention of state-of-the-art technologies to help safeguard the country against terrorism and other threats.

In October 2007, Lawrence Livermore National Security, LLC (LLNS), assumed management of the Laboratory with a vision for positioning Livermore to excel in meeting 21st-century challenges and opportunities. Drawing on LLNS parent organization expertise, we are implementing operational efficiencies to complement our preeminence in science and engineering. We are targeting institutional investments toward those national needs and research capabilities where we can make significant and unique contributions.

This document describes three initiatives that will enable our Laboratory to fulfill its mission through synergistic excellence in science and operations:

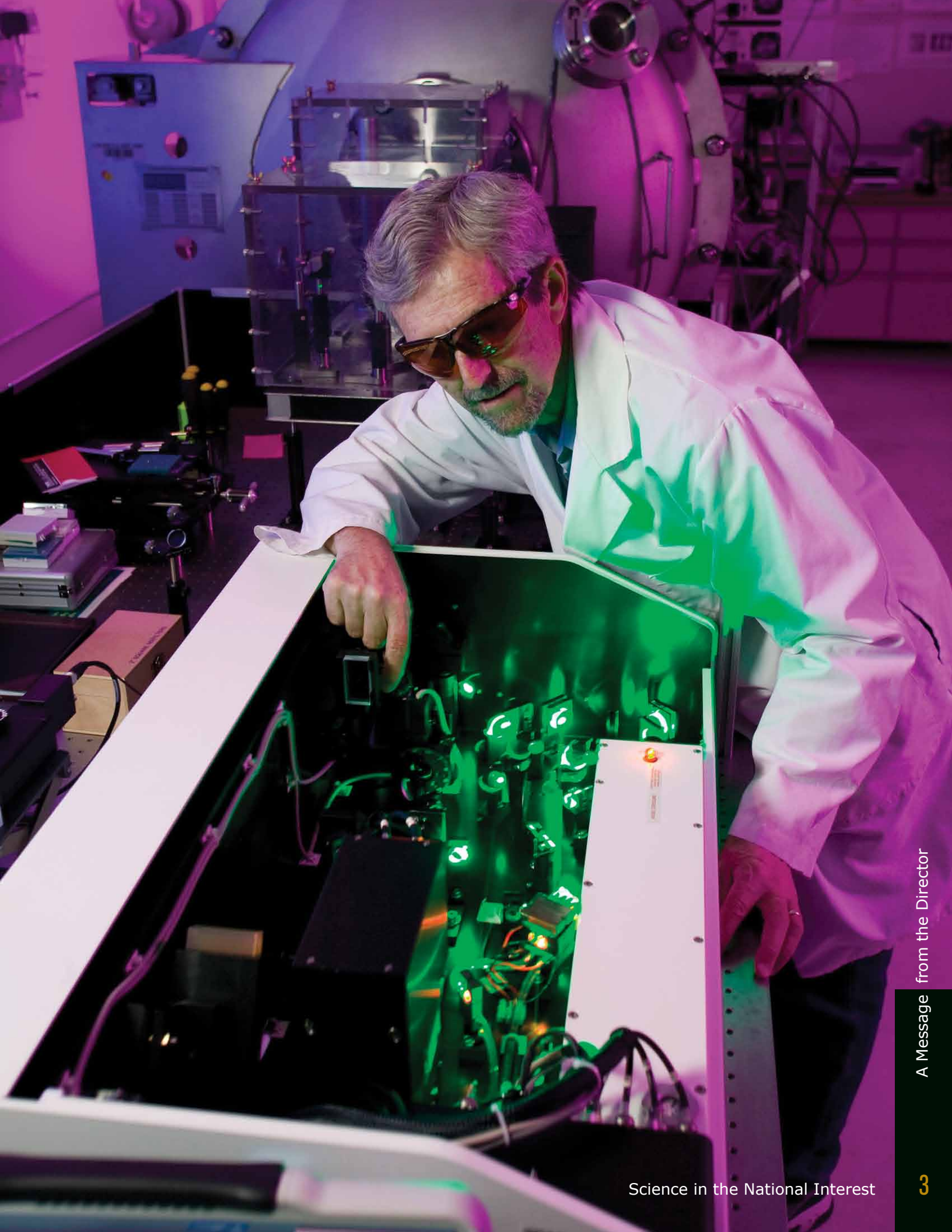
- Leadership in meeting 21st-century national security challenges
- Exceptional science and technology to solve problems of national importance
- Enhanced management, business, and operational performance

We have been entrusted with a critical and compelling mission. Even as we deliver solutions to meet national security needs of today, we are also building capabilities and positioning our Laboratory to meet the country’s needs in the years ahead.

A handwritten signature in black ink that reads "George H. Miller".

LLNL Director and
LLNS President





Unparalleled Passion for Mission

Our Mission

As a preeminent national security laboratory, our mission is to advance and apply science and technology to:

- Ensure the safety, security, and reliability of the U.S. nuclear deterrent
- Reduce or counter threats to national and global security
- Enhance the energy and environmental security of the nation
- Strengthen the nation's economic competitiveness

Teams of Laboratory scientists, engineers, and other researchers work together to achieve technical innovations and scientific breakthroughs and to transform these advances into solutions to nationally important problems.

We continually push the frontiers of knowledge to build the scientific and technological foundations that will be needed to address the security issues of the future.

Our Vision

LLNL is the “go-to” laboratory for science and technology solutions to the toughest and most important problems affecting national and global security.

We are a leader in transforming scientific breakthroughs and cutting-edge engineering into solutions to real-world challenges.

We are recognized for our excellence in business and operations and our responsible stewardship of the resources entrusted to us.

We are sought out as a valued resource to the U.S. government, a collaborator with national laboratories and universities, and a partner with industry.



Our Values

Laboratory employees share a core set of values that guide the way we do our work:

- Passion for mission
- Integrity and responsible stewardship of the public trust
- Personal and collective responsibility for safety and security
- Simultaneous excellence in science and technology, operations, and business practices
- Innovation balanced with disciplined execution
- Teamwork while preserving individual initiative
- Intense competition of ideas with respect for individuals
- Treating each other with dignity
- A high-quality, motivated workforce with diverse ideas, skills, and backgrounds
- Rewarding and recognizing performance
- Commitment to the collective success of the Laboratory

Positioning the Laboratory for the Future

National laboratories are among the elite of this country's research institutions, bringing together large numbers of scientific and engineering experts and world-class research facilities to take on demanding missions and respond to challenges confronting the nation.

LLNL is integral to the nation's security infrastructure and a vital member of the broader scientific community. As a national laboratory, we are charged with advancing science and technology to promote national security and the economic interests of the country.

The challenges facing the nation today are extremely complex and dynamic. We must be proactive and agile in anticipating and developing the capabilities that will be needed to counter future threats to national security and global stability.

We are making strategic advances in three areas that will position the Laboratory to successfully fulfill its critical mission in the years ahead:

Leadership in Meeting 21st-Century National Security Needs. We will provide scientific and technical leadership to ensure the safety, security, and reliability of the nation's nuclear deterrent. We will also apply Laboratory capabilities to achieve breakthroughs for counterterrorism and nonproliferation, defense and intelligence, domestic security, and energy and environmental security.

Exceptional Science and Technology. We will make strategic investments that keep us at the cutting edge of science and technology and sustain the unique capabilities that allow us to anticipate national needs and devise innovative solutions to national security challenges.

Excellence in Management, Business, and Operations. We will implement best practices to achieve excellence in management, improve the efficiency and cost effectiveness of our activities, and ensure that our operations are conducted in a safe, secure, and environmentally responsible manner.

Through these initiatives, we will continue Livermore's tradition of innovation, problem solving, and public service.



What Makes a National Laboratory?

An essential and compelling mission

A committed, vital, and talented staff

The ability to solve important and difficult real-world problems

Cutting-edge capabilities in multiple areas of science and technology

Science and technology that create spin-off applications

Unique, large, and complex research facilities

Partnerships that promote creativity

Management, business practices, and operations that support mission goals

Mission-Focused Multidisciplinary Science

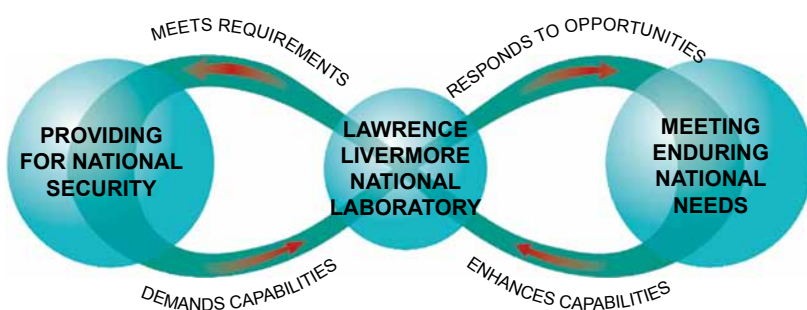
The innovative application of multidisciplinary science and technology coupled with mission-focused specialized capabilities lie at the heart of an exceptional national security laboratory.



Our defining nuclear security mission demands world-leading science and technology, an outstanding workforce, and unique core competencies, including cornerstone facilities. We also apply our unique capabilities to important missions beyond stockpile stewardship. These activities strengthen the Laboratory's science and technology foundation as they generate new ideas, demonstrate novel approaches, and support critical capabilities that apply to all mission areas. Our initiative in *Meeting 21st-Century National Security Needs* focuses the Laboratory's outstanding workforce, capabilities, and facilities on ensuring national security within the global context.

Sustaining and advancing our science and technology base requires a long-term investment strategy. Many of the capabilities and technologies that now are being deployed have their roots in far-sighted investments made decades earlier. Our *Science and Technology Initiative* addresses Livermore's investment strategy for developing the game-changing capabilities needed to counter current and emerging threats to national security.

The nation is best served by a dynamic laboratory with a vibrant portfolio of programs addressing nuclear security issues and other nationally important missions. Effective and cost-efficient operations are critical to our success. Through our *Enhanced Operational Performance Initiative*, we are reducing the cost of doing business while meeting high standards in safety, security, and work performance.



Livermore's Outstanding Workforce

Highly skilled and motivated

- More than two-thirds have advanced degrees, nearly half of which are Ph.D.s

Expertise in a broad range of scientific and technical disciplines

- Physical and life sciences, mathematics, engineering, and more

Widely recognized for innovation and creativity

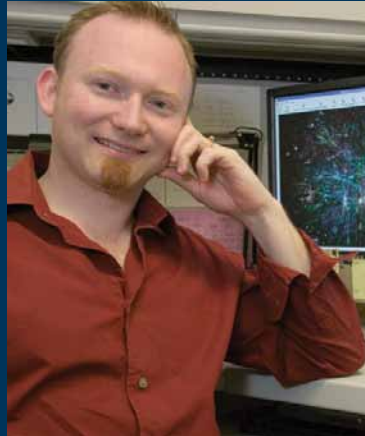
- Hundreds of invention disclosures, patents, and awards

Diversity of backgrounds and perspectives

- Staff demographics reflect the diversity of the San Francisco Bay Area

Dedicated to Laboratory and mission

- More than 50 percent have more than 10 years of service



Laboratory Partnerships and Collaborations

With sponsors and customers to understand their S&T needs and ensure that Livermore-developed products and capabilities meet those needs

With other national laboratories, research institutions, and universities to access expertise and capabilities not resident at Livermore

With industry to jointly develop new technology or to transfer Livermore-developed technology for commercialization


With policy makers to devise technologies for implementing policy and to inform decision makers as to what science and technology can and cannot do

With LLNS parent organizations to tap their expertise in management, business practices, and operations



Leadership in Meeting 21st-Century National Security Needs

Our defining responsibility is the stewardship of the nation's nuclear weapon stockpile. The geopolitical landscape has changed significantly since the Laboratory was founded in 1952, but nuclear deterrence remains a central component of the nation's security strategy. With the cessation of nuclear testing, this mission—which has always required the best in science and technology—is more demanding than ever.



Livermore scientists and engineers are tackling the grand challenge of understanding the scientific details of nuclear weapon performance through nonnuclear tests and experimentally validated computer simulations. We also are leveraging science and technology to help transform the Cold War–era nuclear weapons complex into a smaller, safer, more secure, and more cost-effective complex that meets 21st-century needs.

Centers of Excellence. Our Laboratory serves as a Center of Excellence for Nuclear Design and Engineering, as does Los Alamos National Laboratory, preserving the key feature of two independent design laboratories to ensure confidence in the stockpile. Three unique Livermore facilities are further identified as Centers of Excellence by the Department of Energy: the National Ignition Facility (NIF), the Terascale Simulation Facility, and the High Explosives Applications Facility. These facilities provide unique capabilities for investigating the properties and behavior of weapon materials and components under extreme conditions. We also provide world-class capabilities in energetic materials research, development, and testing with our High Explosives Applications Facility.

Resolution of Key Weapons Physics Issues. NIF is the only facility in the world capable of creating, in a laboratory setting, the physics regimes necessary to resolve key issues about the “nuclear” performance of nuclear weapons. Results from NIF experiments will allow researchers to develop and validate vastly improved weapon physics simulations. The overarching



Leadership in Stockpile Stewardship

First successful completion of a stockpile life extension program (the W87 ICBM warhead) and selected as the preferred design for the Reliable Replacement Warhead

Acquisition of a series of the world's most powerful supercomputers and development of groundbreaking applications, used to perform the first high-fidelity three-dimensional simulations of weapon physics phenomena

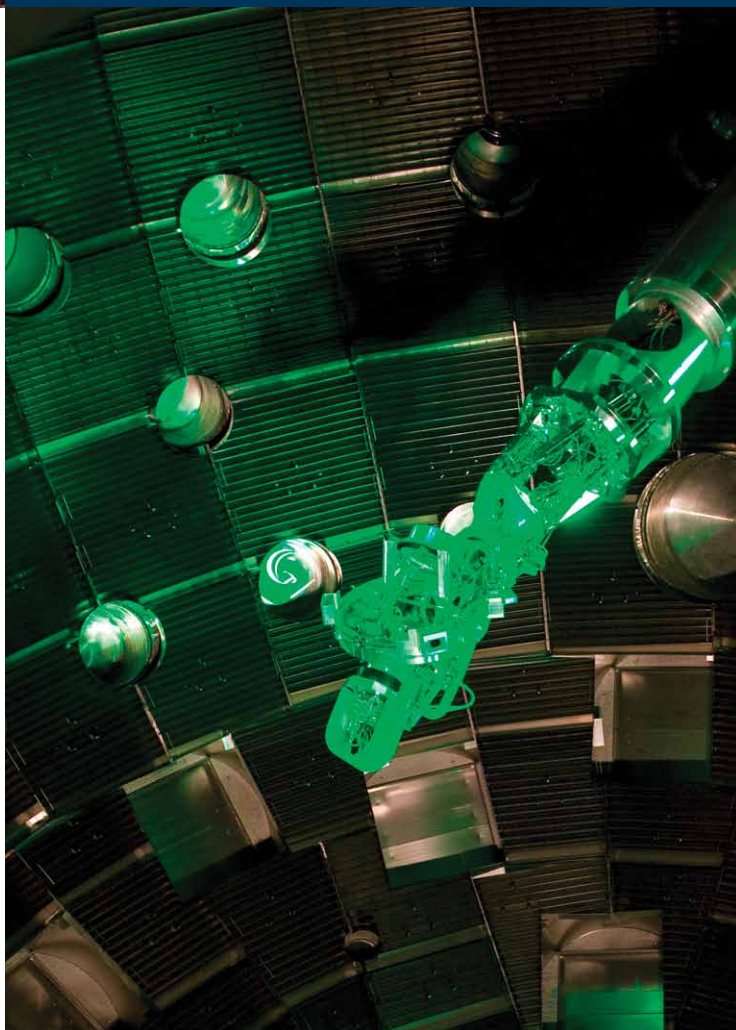
Design and construction of NIF, the world's largest laser system, unique in its capabilities to experimentally investigate key issues in the thermonuclear performance of weapons

goal is to develop fully predictive models that eliminate the need for nuclear testing to ensure stockpile safety, reliability, and performance.

Improved Capabilities and Processes for Stockpile Assessment and Certification. We continue to improve the science-based methodology for weapon certification and will acquire increasingly powerful supercomputers to more rigorously apply this methodology. These capabilities, together with improvements in weapon science and stockpile surveillance, make it possible for the Livermore and Los Alamos laboratories to carry out comprehensive independent analyses of all stockpile systems, which are central to the annual assessment process.

Options for the Future Stockpile. Livermore provides a range of options for the nation to consider for the long-term U.S. nuclear stockpile—from incremental life extension programs for current warheads to life extension programs with innovative reuse of weapon components and/or reliable replacement warheads. The goals are to reduce stockpile size, lower manufacturing costs, provide greater safety and security in weapons, and reduce the risk of needing a nuclear test.

Complex Transformation. We are providing leadership to make the nuclear weapons complex more cost effective and safer. The majority of our inventory of special nuclear material is being packaged and shipped off site for consolidation at other facilities; the deinventory will be completed in 2012. We also are reducing our facility footprint by 2 million square feet (roughly 25 percent) through improved space use. In addition, facilities at Site 300, the Laboratory's remote experimental test site, will be phased out as they become programmatically unnecessary.



National Ignition Facility

World's largest laser system

Unique capabilities to achieve fusion ignition and thermonuclear burn in the laboratory

Resolve key issues about the "nuclear" performance of nuclear weapons

Achieve breakthroughs in high-energy-density physics

Pursue laser inertial confinement fusion–fission sustainable energy concept



Terascale Simulation Facility

Supercomputing platform host site

Home to Advanced Simulation and Computing Purple and BlueGene/L, two of the world's top-performing computers

Future home of Sequoia, which will perform 14–20 quadrillion operations per second by 2012

High Explosives Applications Facility

One-of-a-kind facility for research and development in high explosives and energetic materials

Laboratories for synthesis, formulation, characterization, and testing of explosives

Fully contained vessels capable of handling 1-gram to 10-kilogram quantities of explosives

Extensive, high-fidelity, high-speed diagnostic capabilities



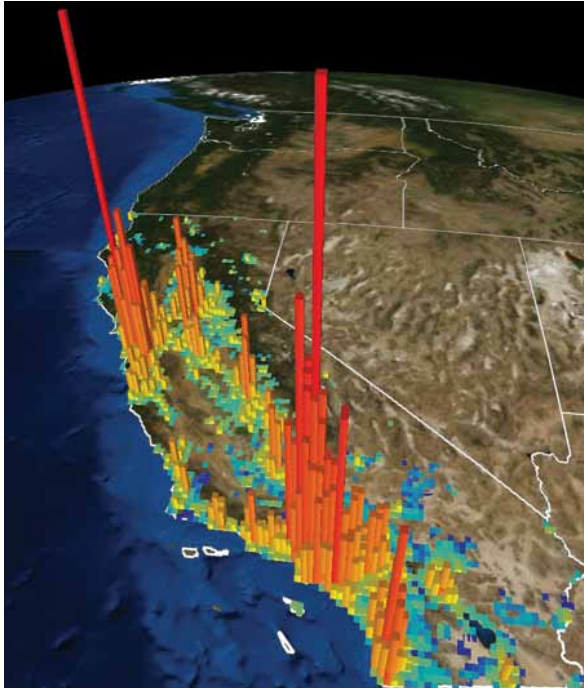
Our national security mission is broader than stockpile stewardship. In today's interconnected world, national security is not a single-state issue but must be addressed in the global context. The threats posed by asymmetric warfare or the proliferation of weapons of mass destruction know no boundaries. Likewise, energy and environmental issues are not confined by national borders but have intercontinental reach and effect. Livermore is ideally suited to take on these 21st-century challenges.



To this end, we reach out to government decision makers and agencies beyond our traditional sponsors to understand their needs and identify areas where Livermore capabilities can be applied to solve pressing problems. Our goal is to develop long-term trusted relationships with sponsors, where we work together to anticipate needs, define the capabilities required to meet those needs, and proactively develop, sustain, and advance the underlying scientific and engineering infrastructure.

We are focusing on the nexus of national need and Livermore's core capabilities, where new programs can benefit the Laboratory, the nation, and the world.

Counterterrorism and Nonproliferation. The global nuclear security threat is being driven by the spread of nuclear weapons technology and the expanding need for civilian nuclear power. Livermore will continue to develop improved capabilities for preventing nuclear terrorism, mitigating the consequences of a terrorist event, and identifying the parties responsible. We will also continue to develop advanced nuclear safeguards technologies and new systems for detecting, characterizing, and monitoring proliferation-related activities.



Defense and Intelligence. The Laboratory will provide innovation in decision and information science, sensing technology, nanotechnology, and other fields to provide the defense and intelligence communities with global situational awareness capabilities for both the physical world and cyberspace. In addition, capabilities developed for our nuclear weapons work will be applied to enhance agility, survivability, and lethality for the U.S. military.

Domestic Security. Livermore provides a center of innovation for new technologies and systems for protecting the nation against nuclear, biological, and other catastrophic threats. We will draw on the full spectrum of Laboratory capabilities to devise increasingly capable detection systems, secure critical transportation systems and infrastructures, and enable more effective emergency

Rapid Identification of Biothreats

Potentially catastrophic consequences of new, emerging, or evolving biological threats

Rapid pathogen identification for effective response to pandemic or bioterrorist attack

Achievable through comprehensive integration of surveillance, detection, and bioinformatics technologies

Benefits national security, public health, and global stability



response and recovery. In particular, we will integrate fundamental science, technology development, and information science to enable the near-real-time detection and identification of new diseases or biological threats.

Energy and Environmental Security. Energy and environmental resources are critical to national security and global stability. We will leverage Laboratory strengths to develop diverse, secure, and sustainable energy technologies while understanding and reducing their environmental impact. Particular focus will be on proliferation-resistant nuclear energy options, including new nuclear fuel materials and the Laser Inertial Confinement Fusion–Fission Energy (LIFE) concept, alternative energy options such as hydrogen power and carbon capture and sequestration, and climate modeling to understand the effects of these and other energy options on climate change at global to local scales.

Economic Competitiveness. The Laboratory's science and engineering breakthroughs will contribute to the nation's economic competitiveness with innovations that promote affordable and abundant clean energy and water, lead to new products and spinoff technologies for the health care, information, and manufacturing sectors, and provide tools that increase human knowledge about our world and cosmos.

Laser Inertial Confinement Fusion–Fission Energy (LIFE)

Exciting new concept for providing almost unlimited energy

Combines the underlying fusion principles of NIF with elements of conventional fission nuclear power plants

Eliminates many of the drawbacks inherent in fission power plants

- Always far from criticality
- Minimizes long-lived radioactive waste
- Mitigates major aspects of nuclear proliferation problem



Game-Changing Science and Technology

Exceptional science and technology is the engine that sustains the Laboratory's vitality and makes it possible for Livermore to take on demanding missions and respond to national challenges as they arise.

Staying at the leading edge of science and engineering requires continuing investment in our workforce and our S&T infrastructure. Our strategic S&T investments—pursuing exploratory research, creating and revitalizing capabilities, and recruiting staff with critical skills—pave the way for breakthroughs in our traditional missions and enable the development of exciting new programs.

Core Capabilities. Our Laboratory's distinguishing core competencies derive from its historical nuclear weapons mission, its continuing stockpile stewardship responsibilities, and its broader mission in national and global security. They include all aspects of the science and engineering involved in nuclear weapons as well as high-performance computing, micro- and nano-technology, lasers and high-energy-density science, climate modeling, detection and remote sensing, and complex systems and analysis.





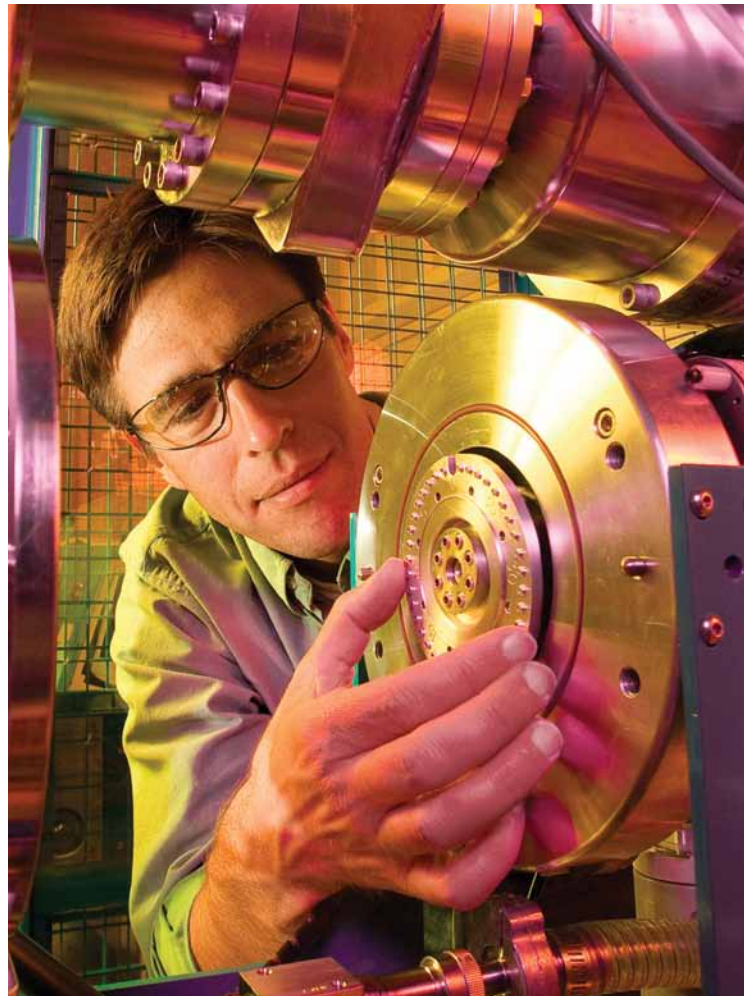
Unique Facilities. Livermore is home to a number of unique facilities and capabilities. The National Ignition Facility, Terascale Simulation Facility, and High Explosives Applications Facility are signature facilities and will serve as major user resources for years to come.

We also support a number of scientific centers and facilities, including the National Atmospheric Release Advisory Center, Plutonium Facility, Jupiter Laser Facility, Center for Accelerator Mass Spectrometry, Forensic Science Center, and Biodefense Knowledge Center. These resources enable us to provide specialized technical assistance and analysis for emergency response, homeland security, basic research, and other nationally important endeavors.

Focused Investments. We engage in strategic planning to ensure that institutional investments are targeted at the intersection of S&T potential and national needs. Through these investments, we position the Laboratory to address emerging and future national security threats.

We are making strategic S&T investments in:

- Weapons and defense science
- Nuclear counterterrorism and nuclear forensics
- Cyber security, space security, and intelligence
- Biosecurity
- Regional climate change
- Laser inertial confinement fusion–fission energy





Outstanding Workforce. The scientific and technical difficulty of the Laboratory's mission requires an exceptional workforce. We take a strategic approach toward recruiting, developing, and sustaining a workforce with the critical skills needed to solve today's and tomorrow's national security problems. Our proximity to Silicon Valley, other high-technology centers, and several of the world's top research universities is both a benefit and a challenge, providing a wealth of local talent and competition for that talent.

Strategic Partnerships. With outstanding capabilities in multiple scientific and technical disciplines, Livermore pursues a synergistic portfolio of programs in national security and basic science. We engage in partnerships with other laboratories, research universities, and high-technology industries so that the expertise and special capabilities of multiple institutions can be leveraged to address nationally and globally important challenges.

One particularly strong partnership is with our sister laboratory at Los Alamos. Cooperative efforts are growing through shared complex transformation initiatives and



the interactions of the two laboratories' Boards of Governors. In addition, Livermore has many strong ties to the University of California system and is growing relationships with the Battelle-managed national laboratories and Texas A&M University.

Multidisciplinary Teams. A hallmark strength of this Laboratory is our ability to rapidly assemble project teams of scientists, engineers, and technical staff with the full range of skills needed for a particular project. Research and development at Livermore incorporates rigorous peer review and best practices in project management. Through this multidisciplinary team approach to scientific problem-solving, we have repeatedly achieved unexpected insights, scientific breakthroughs, and technological innovations.



Livermore's Distinguishing Core Capabilities

Nuclear Science and Technology.

Understanding, at the first-principles level, all aspects of nuclear weapons performance, the nuclear fuel cycle, and nuclear forensics

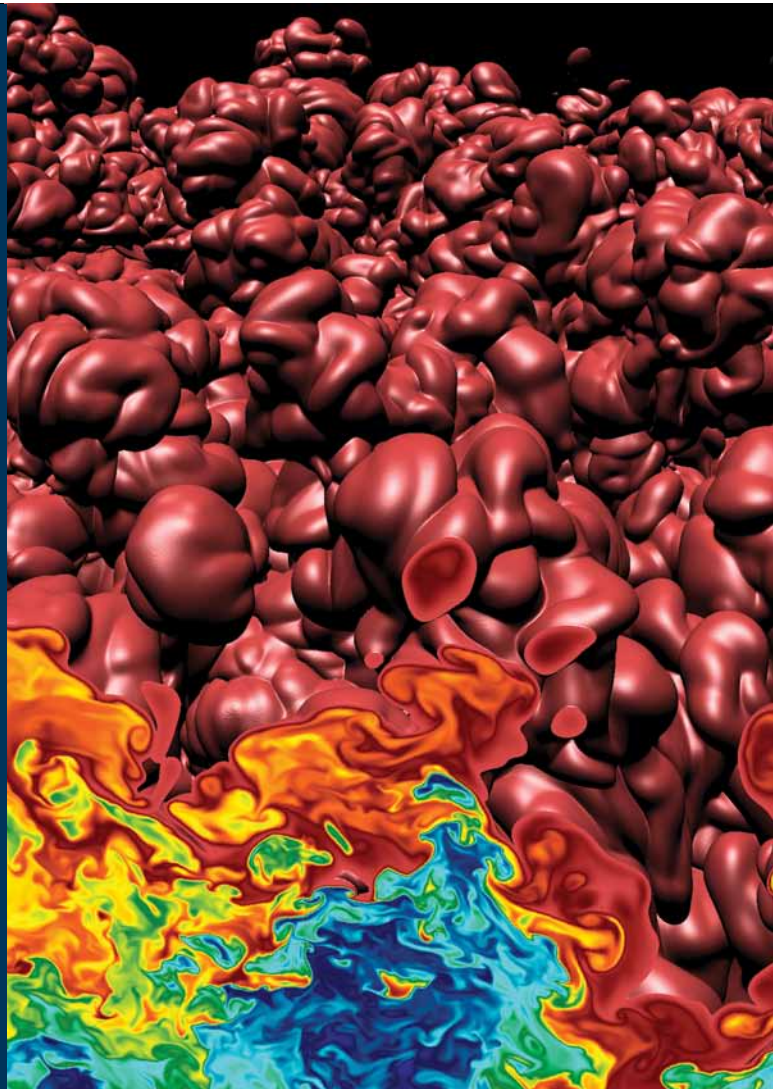
High-Performance Computing. Leading the development of new computer architectures, predictive simulation capabilities, knowledge extraction tools and techniques, and novel algorithms and codes

High-Energy-Density Physics. Developing the National Ignition Facility into a premier user facility for stockpile stewardship, discovery-class science, and new approaches to clean energy

Materials Science. Understanding materials from the nano- to the macro-scale and engineering new materials for specific applications

Advanced Photon Sources and Diagnostics. Developing advanced photon sources and sensors as well as nanoscale–picosecond diagnostics for national security missions and scientific discovery

Engineering Development and Systems Technologies. Integrating individual technologies and capabilities into end-to-end systems solutions for nationally or globally important problems



Excellence in Management, Business, and Operations

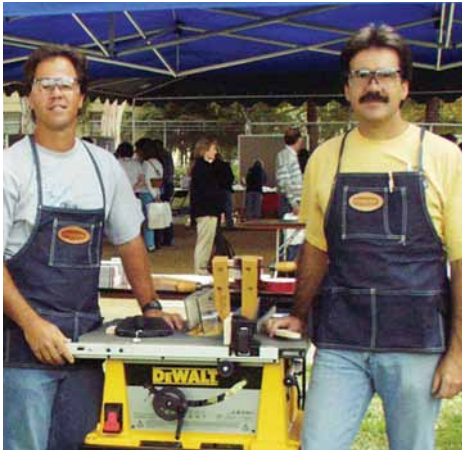
The Laboratory is committed to simultaneous excellence in science and operations. Effective management, efficient business practices, and safe, secure, and environmentally responsible operations provide the essential foundation for our mission activities.

Through the LLNS partnership, we have access to an unmatched experience base in management, business practices, and operations, including nuclear operations. We draw on the expertise of the LLNS parent organizations to identify opportunities for increasing the effectiveness and reducing the cost of Laboratory activities.

We aim for continuous improvement in safety, security, and environmental stewardship. These considerations are explicitly designed into all Laboratory activities.

Success in both science and operations depends on teamwork, and teamwork depends on people. We strive to recruit, develop, and sustain an outstanding and diverse workforce.





Initiatives to enhance Laboratory management, business practices, and operational performance span the full gamut of our activities:

Contractor Assurance System. Implementing an integrated system with the insight and information necessary to ensure the Laboratory is meeting its performance requirements and to provide transparency and accountability to stakeholders and customers

Human Capital Management. Ensuring the Laboratory has the workforce required to meet current and future mission needs

Environment, Safety, Health, and Quality. Streamlining and improving our work planning and control processes

Safeguards and Security. Continually improving physical and cyber security to anticipate and protect against evolving threats





Nuclear Operations. Implementing enhanced training, procedures, and processes for activities involving nuclear materials

Emergency Management. Providing effective capabilities for emergency response and recovery both on site and in mutual aid

Business Operations. Implementing modern business systems (in partnership with Los Alamos) and integrated supply chain management

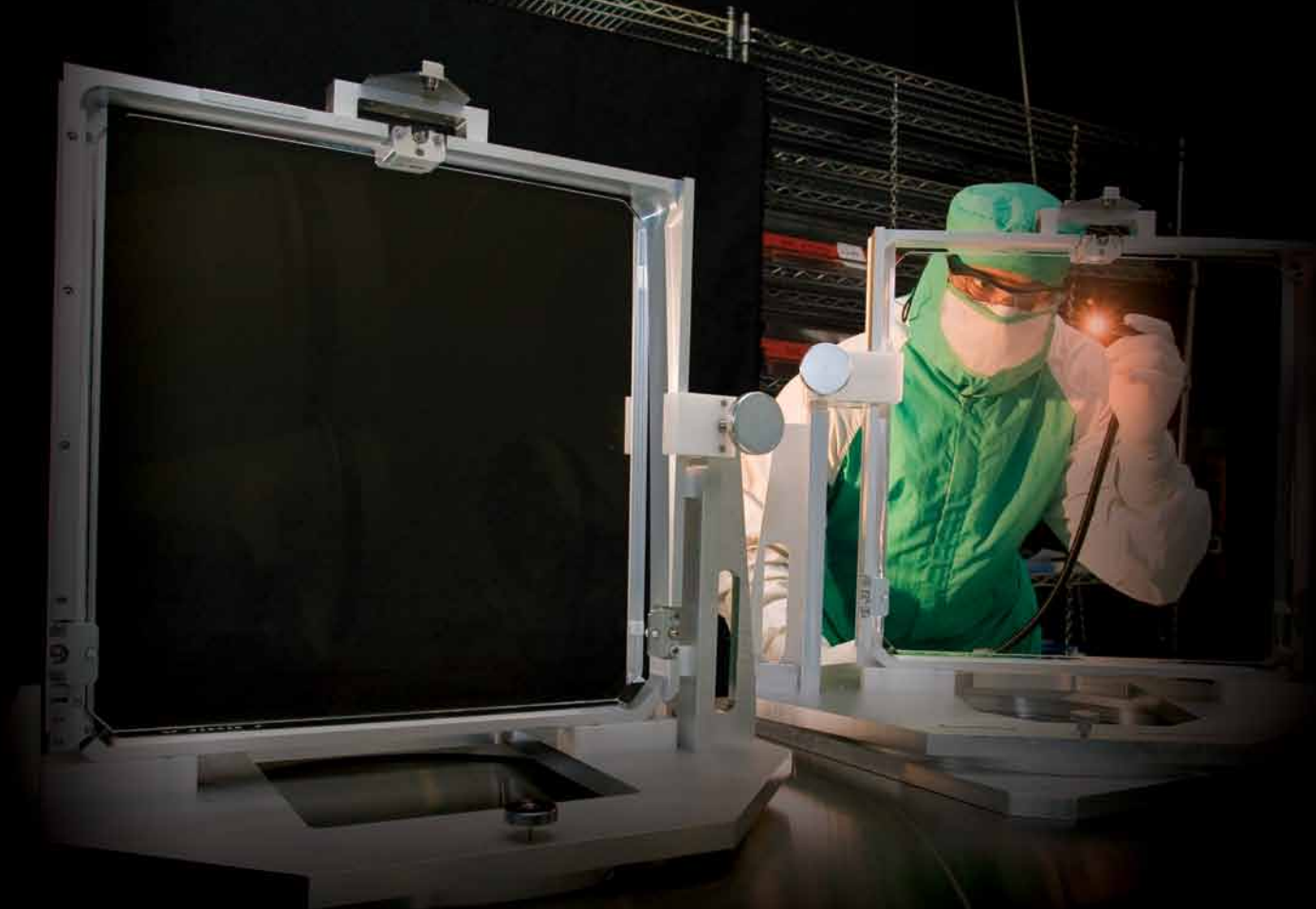
Project Controls. Implementing a Laboratory-wide Earned Value Management System, new project control functions, and an institutional work breakdown structure

Financial Management. Enhancing the Laboratory's financial accountability through best-practice financial systems and performance-based budgeting

Information Resource Management. Improving the security, performance, and agility of these systems while dramatically reducing costs

Facilities and Infrastructure. Centralizing and improving facilities management and reducing the site footprint by 2 million square feet by 2011





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